UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/641,356	08/14/2003	Holger Mathiszik	414-30676-US	1175

24923 7590 09/13/2006

PAUL S MADAN
MADAN, MOSSMAN & SRIRAM, PC
2603 AUGUSTA, SUITE 700
HOUSTON, TX 77057-1130

EXAMINER	
HUGHES, SCOTT A	

ART UNIT	PAPER NUMBER
3663	

DATE MAILED: 09/13/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/641,356	MATHISZIK ET AL.	
	Examiner	Art Unit	
	Scott A Hughes	3663	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 July 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-28* is/are rejected.

7)☒ Claim(s) *10 and 22* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *14 August 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments filed 7/3/2006 have been fully considered but they are not persuasive.

With respect to claims 1 and 18, applicant argues that the embodiment in the Leggett '294 reference that teaches receiving a reflected signal does not disclose signal propagating along an axial direction (It is noted that in the arguments applicant identifies Col. 8 lines 40-62 as a portion of the reference cited by the examiner, and that this should have been col. 9, lines 40-62 as stated in the prior office action). Applicant argues that the embodiment of Leggett '294 that deals with receiving reflected signals (Fig. 5a) does not involve signals propagating in an axial direction. These arguments are not persuasive. The apparatus shown for receiving reflected signals (Figs. 5a and 7) shows a source array T1,T2 "which emits a preselected acoustic signal in the borehole axis direction into the earth formation" and also "at least one receiver on the BHA which receives a second acoustic signal produced by reflection of said preselected acoustic signals in said formation" as recited in claim 1. The claim language states that the source array emits a preselected acoustic signal in the borehole axis direction. The two transmitters of the tool of Fig. 7 produce signals that have at least one component of the signal which travels in the borehole axis direction. Therefore, the transmitters emit an acoustic signal in the borehole axis direction and read on the claim limitation of claim 1. The claim limitation is broad enough that the entire acoustic signal is not limited to travel in the borehole axis direction, and any part of an acoustic signal which

travels in the borehole axis direction meets the claim language. As a component of the signals in Leggett '294 travel in the borehole axis direction, Leggett '294 discloses signals propagating in an axial direction.

Applicant makes the same argument for claim 18 as was addressed above for claim 1.

With regard to claims 1-5, 10, 18, 20-22 and 25-27 rejected over the Leggett '360 reference (incorrectly identified in the first line of the arguments as US 6084826 to Leggett but correctly defined as Leggett '360 in the rest of the arguments relating to the 102 (e) rejection), applicant argues that the cited Fig. 8 and section of the disclosure dealing with Fig. 8 in Leggett '360 show that "the raypaths from the transmitter 180 are not in an axial direction." This argument is not persuasive as the claim language does not refer to "raypaths" being in an axial direction. The claim language refers to a source that emits signals in the borehole axis direction. The claim limitations are therefore of a different scope than applicant's arguments as the claim language does not refer to raypaths but rather to an acoustic signal. The claim limitation is broad enough that the entire acoustic signal is not limited to travel in the borehole axis direction, and any part of an acoustic signal which travels in the borehole axis direction meets the claim language. The Leggett '360 shows the segmented transmitter 180 emitting signals in the borehole that include components that along the borehole axis. Therefore, the device emits acoustic signals that travel in the borehole axis direction (the components

of emitted signals, e.g. signal 190, that travel in the borehole axis direction as the move ahead of the transmitter).

Applicant states that the same arguments addressed above with respect to claim 1 apply to claim 18.

Applicant's arguments with respect to amended claim 11 are moot in view of the new grounds of rejection presented below.

Claim Objections

Claim 10 is objected to because of the following informalities: Claim 10 appears to be labeled both as cancelled and also as original. The claim is either pending and is in original form, or is cancelled, and only one label should be used. If claim 10 is still pending, it is objected to for failing to further limit parent claim 1, as both claims contain the limitation that at least one receiver receives a second acoustic signal that has traversed a part of the formation (reflected in the formation is a signal that has traversed a part of the formation).

Appropriate correction is required.

Claim 22 is objected to because of the following informalities: Claim 22 reads, "processes said acquired signals by further comprises defining." The term "comprises" appears to be an extra word in the claim language that makes the claim have incorrect grammar. Appropriate correction is required

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 18-28 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 18 recites the limitation "said parameter of interest" in step (b). There is insufficient antecedent basis for this limitation in the claim. The preamble refers to a property of an earth formation, but it is unclear if this property is the same as the "parameter of interest" recited in the claim. If the two are the same, consistent language for the same limitation ("parameter of interest" or "property of an earth formation") should be used.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-4, 6, 10, 18-22, and 24-27 are rejected under 35 U.S.C. 102(b) as being anticipated by Leggett ('294).

With regard to claim 1, Leggett discloses an acoustic logging apparatus. Leggett discloses a bottom hole assembly 59 (Fig. 1) conveyed on a drilling tubular 20 in a borehole within an earth formation (Column 7, Lines 5-15), said BHA comprising a source array which emits a preselected acoustic signal in the borehole axis direction into the earth formation (Figs. 5a, 7) (Column 9, Lines 40-62; Column 11, Line 32 to Column 12, Line 50; Column 13 Line 20 to Column 14, Line 68; Column 15, Lines 36-55). Since some of the waveform emitted by the transducers travels in the borehole axis direction, the Leggett reference recites a signal in the borehole axis direction. Leggett discloses at least one receiver R (Fig. 7) on the BHA which receives a second acoustic signal produced by a reflection of said preselected acoustic signals with the formation (Column 11, Lines 33-67; Column 13, Line 20 to Column 14, Line 68).

With regard to claim 2, Leggett discloses that the source comprises an azimuthally distributed array of axially directed sources T1, T2 (Figs. 3a, 7) (Column 9, Lines 40-62).

With regard to claim 3, Leggett discloses activating the source array according to pre-selected sequential time delays (Column 15, Lines 42-45).

With regard to claim 4, Leggett discloses that the source array emits the preselected acoustic signal differing in spectrum or wavemode from the acoustic energy of the rotating drillstring (Column 15, Lines 36-40). Leggett discloses that the transmitters are adapted to transmit signals at a desired frequency level or that they can sweep a range of frequencies. Leggett discloses earlier a need to get rid of background

noise (Column 12), and therefore the range and selected frequencies of Leggett would be different in spectrum and wave mode from the acoustic energy of the rotating drill string.

With regard to claim 6, Leggett discloses a receiver located at least two wavelengths from an element of the source array (Column 9, Lines 41-62). Leggett discloses that the far receivers are located 4.5 meters from the source. Since the source is operating at 5-20KHz, and the acoustic velocity is a parameter that is trying to be determined, the distance would necessarily be more than two wavelengths from the source to the receiver.

With regard to claim 10, Leggett discloses that one of the receivers receives the second signal that has traversed part of the formation (Fig. 5) (Column 11, Lines 33-67).

With regard to claim 18, Leggett discloses a system for determining a property of an earth formation using an acoustic logging tool on a bottom hole assembly in a borehole in an earth formation. Leggett discloses at least one source array in an acoustic logging tool which generates a preselected acoustic signal along a borehole axis direction into the formation, with the preselected acoustic signals differing in spectrum and/or wave mode from acoustic energy of a rotating drill string (Figs. 5a, 7) (Column 9, Lines 40-62; Column 11, Line 32 to Column 12, Line 50; Column 13 Line 20 to Column 14, Line 68; Column 15, Line 36 to Column 16, Line 22). Since some of the waveform emitted by the transducers travels in the borehole axis direction, the Leggett reference recites signals in the borehole axis direction. Leggett discloses that the

transmitters are adapted to transmit signals at a desired frequency level or that they can sweep a range of frequencies. Leggett discloses earlier a need to get rid of background noise (Column 12), and therefore the range and selected frequencies of Leggett would be different in spectrum and wave mode from the acoustic energy of the rotating drill string. Leggett discloses a plurality of receivers R on the logging tool which receive signals indicative of a parameter of interest (Fig. 7) (Column 11, Lines 33-67; Column 13, Line 20 to Column 14, Line 68). Leggett discloses acquiring signals at a plurality of depths of the BHA (Columns 3-4). Leggett discloses that the measurements are made to geosteer the bit and to update formation models. Therefore, the measurements are necessarily made at a plurality of depths to be able to continue to steer the bit as the drilling progresses and to update the formation model as the borehole depth progresses. Leggett discloses a processor which processes the acquired signals to obtain the parameter of interest (Column 4, Lines 1-5; Columns 15-16).

With regard to claim 19, Leggett discloses that the signals are acquired when the BHA is not in contact with the bottom of the borehole (Column 10, Lines 1-10). Leggett discloses performing the measurements while the drilling is stopped, and therefore the drill bit would not be in contact with the bottom of the borehole. Also, the drill bit is between the BHA and the bottom of the borehole, and therefore the BHA does not contact the bottom.

With regard to claim 20, Leggett discloses that the source comprises an azimuthally distributed array of axially directed sources T1, T2 (Figs. 3a,7) (Column 9, Lines 40-62).

With regard to claim 21, Leggett discloses sequentially firing the source array in the borehole axial direction according to a pre-selected sequential time delays (Column 15, Lines 42-45).

With regard to claim 22, Leggett discloses that processor processes the acquired signals by further defining an imaging ahead of the drill bit along the axis of the borehole (Column 14, Lines 48-54). Leggett discloses that the sonic measurements are used for look-ahead measurements. Since Leggett is disclosing look-ahead measurement along with the geosteering of a drill bit in a borehole, his disclosure is read as defining imaging ahead of the drill bit along the axis of the borehole.

With regard to claim 24, Leggett discloses that processor processes the signals by further defining time shifts according to a pre-selected imaging direction (Column 12, Lines 35-50). Leggett discloses pre-processing including dynamic corrections. It is known that dynamic corrections are time-shift corrections that align the data along a certain direction (Encyclopedia of Exploration Geophysics).

With regard to claim 25, Leggett discloses that the processor processes the signals by further compressing and transmitting the signals to the surface substantially in real time (Column 15, Line 36 to Column 16, Line 22).

With regard to claim 26, Leggett discloses that the processor processes the signals by further performing full waveform processing in the BHA (Column 5, Lines 52-67; Column 15, Lines 36-65).

With regard to claim 27, Leggett discloses that information from the full waveform processing in the BHA is used for a downhole control of a geosteering system (Column 4, Lines 37-48; Column 5, Lines 52-67).

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-5, 10, 18, 20-22, and 25-27 are rejected under 35 U.S.C. 102(e) as being unpatentable over Leggett '360.

With regard to claim 1, discloses an acoustic logging apparatus. Leggett discloses a bottom hole assembly 20 (Fig. 1) conveyed on a drilling tubular in a borehole within an earth formation (Column 7, Lines 31-35; Column 9), said BHA comprising a source array which emits a preselected acoustic signal in the borehole axis direction into the earth formation (Figs. 4a,b, 6, 8) (Column 9; Column 11, Lines 39-65). Leggett discloses at least one receiver 199, 182 (Fig. 8) on the BHA which receives a second acoustic signal produced by reflection of said preselected acoustic

With regard to claim 2, Leggett discloses that the source comprises an azimuthally distributed array of axially directed sources and azimuthally distributed arrays of azimuthally directed sources (Fig. 4) (Column 5, Lines 7-11).

With regard to claim 3, Leggett discloses that the source array is activated according to pre-selected sequential time delays (Column 11, Lines 39-60).

With regard to claim 4, Leggett discloses that the source array emits preselected acoustic signals differing in spectrum or wavemode from the acoustic energy of the rotating drillstring (Column 12, Lines 27-62).

With regard to claim 5, Leggett discloses that the transmitters can be monopole, dipole, or quadrapole (abstract, Column 6, Lines 18-31).

With regard to claim 10, Leggett discloses that one of the receivers 199 receives the second signal 192' that has traversed part of the formation (Fig. 8).

With regard to claim 18, Leggett discloses a system for determining a property of an earth formation using an acoustic logging tool on a bottomhole assembly in a borehole in an earth formation. Leggett discloses at least one source array in an acoustic logging tool which generates a preselected acoustic signal along a borehole axis direction into the formation, with the preselected acoustic signals differing in spectrum and/or wave mode from acoustic energy of a rotating drill string (Figs. 4a,b, 6, 8) (Column 9; Column 11, Lines 39-65). Leggett discloses that the drillstring rotates at 2Hz (120 rpm) (Column 18), and discloses that the frequency spectrum of the source array is between 500 Hz and 20KHz (Column 12), which is a different spectrum that the energy of the rotating drills. Leggett discloses a plurality of receivers 199 on the logging

tool which receive signals indicative of a parameter of interest (Fig. 8). Leggett discloses acquiring signals at a plurality of depths of the BHA (Columns 5, Line 44 to Column 6, Line 47). Leggett discloses that the measurements are made to geosteer the bit and to update formation models. Therefore, the measurements are necessarily made at a plurality of depths to be able to continue to steer the bit as the drilling progresses and to update the formation model as the borehole depth progresses. Leggett discloses a processor which processes the acquired signals to obtain the parameter of interest (Column 6, Lines 18-48).

With regard to claim 19, Leggett discloses that the signals are acquired when the BHA is not in contact with the bottom of the borehole (Fig. 1). The BHA is above the drillbit and therefore it does not contact the bottom of the borehole.

With regard to claim 20, Leggett discloses that the source comprises an azimuthally distributed array of axially directed sources and azimuthally distributed arrays of azimuthally directed sources (Fig. 4) (Column 5, Lines 7-11).

With regard to claim 21, Leggett discloses sequentially firing the source array in the borehole axial direction according to a pre-selected sequential time delays (Column 11, Lines 39-60).

With regard to claim 22, Leggett discloses that the processor processing the acquired signal by defining an imaging ahead of the drill bit along the axis of the borehole (Column 5, Lines 7-35).

With regard to claim 25, Leggett discloses that the processor processing the acquired signal by compressing and transmitting the signals to the surface substantially in real time (Column 7, Lines 42-67; Column 14, Lines 1-12).

With regard to claim 26, Leggett discloses that the processor processing the acquired signal by processing full waveform processing in the BHA (Column 13, Lines 26-30; Column 14, Lines 1-12).

With regard to claim 27, Leggett discloses that information from the full waveform processing in the BHA is used for a downhole control of a geosteering system (Column 14, Lines 25-32).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 11-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Leggett '294 in view of Leggett '826.

With regard to claim 11, Leggett '294 discloses a method of obtaining information about a parameter of interest of an earth formation (abstract). Leggett '294 discloses using a drill bit 50 on a bottom hole assembly conveyed on a drilling tubular for drilling a borehole in the earth formation (Column 4, Lines 49-65) (Fig. 1). Leggett '294 discloses suspending drilling operations and using the drilling tubular to move the drill bit away from the bottom of the borehole (Column 9, Line 63 to Column 10, Line 10). Although

Leggett '294 does not specifically disclose moving the drill bit away from the bottom of the borehole, he does disclose that drilling is stopped before the acoustic signals are generated, and in order to stop the drilling, the drill bit would lose contact with the bottom of the borehole. Leggett '294 discloses generating an acoustic signal in the borehole axis direction into the earth formation using an acoustic source array T on the BHA (Fig. 7) (Column 13, Lines 20-54; Column 14, Lines 55-63; Column 9, Line 63 to Column 10, Line 10). Since some of the waveform travels in the borehole axis direction, the Leggett '294 reference contains the limitation of generating an acoustic signal in the borehole axis direction. Leggett '294 discloses determining a parameter of interest (acoustic velocity, bed boundary information) from a received signal resulting from a reflection of the generated acoustic signal with the earth formation (Column 9, Line 63 to Column 10, Line 10; (Column 11, Lines 33-67; Column 13, Line 20 to Column 14, Line 68). Leggett '294 does not specifically disclose that the source array is an axially directed source array. Leggett '826 teaches a borehole logging tool mounted above a drill bit that is used to make measurements of the formation surrounding a borehole (Figs. 1, 6, 8). Leggett '826 teaches using an axially directed source array (range of angles from 0 to 180 degrees with respect to axis of the borehole includes axially directed along the borehole) to transmit signals into the formation (abstract; Column 10, Line 45 to Column 11, Line 45; Column 13, Line 30 to Column 14, Line 37). It would have been obvious to modify Leggett '294 to include an axially directed source array as taught by Leggett '826 in order to be able focus the emitted energy along desired paths for evaluating the formation and for looking ahead of the drill bit.

With regard to claim 12, Leggett '294 discloses generating an acoustic signal comprising sequentially activating elements of an acoustic source array (Column 9, Lines 63-67; Column 15, Lines 42-44).

With regard to claim 13, Leggett '294 discloses that generating the acoustic signal further comprises activating elements of the acoustic source array in the borehole axial direction according to a pre-selected sequential time delay (Column 9, Lines 63-67; Column 15, Lines 42-44) (Fig. 7).

With regard to claim 14, Leggett '294 discloses that the received signal has traversed part of the earth formation that is adjacent to the borehole (Fig. 5) (Column 11, Lines 33-67).

With regard to claim 15, Leggett '294 discloses that determining the parameter of interest comprises defining a reflector imaging direction that is parallel to the axis of the borehole, oblique to the axis of the borehole, or perpendicular to the axis of the borehole depending upon the orientation of the reflector (bed boundary) (Figs. 3a, 7) (Column 11, Lines 33-67).

With regard to claim 16, Leggett '294 discloses that the generated acoustic signal is differing in a spectrum of acoustic energy of a rotating drillstring (Column 15, Lines 36-40). Leggett '294 discloses that the transmitters are adapted to transmit signals at a desired frequency level or that they can sweep a range of frequencies. Leggett '294 discloses earlier a need to get rid of background noise (Column 12), and therefore the range and selected frequencies of Leggett '294 would be different in spectrum and wave mode from the acoustic energy of the rotating drill string.

Claims 5 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Leggett '294 and Leggett '294 in view of Leggett '826 as applied to claims 1-4, 6, 10-16, 18-22, and 24-27 above and further in view of Leggett '360.

With regard to claims 5, 17 Leggett '294 does not disclose that the acoustic transmitters are monopole, dipole, or quadrapole sources. Leggett '360 discloses a similar BHA tool used for acoustic measurements in boreholes. Leggett '360 discloses that the transmitters can be monopole, dipole, or quadrapole (abstract, Column 6, Lines 18-31). It would have been obvious to modify Leggett '294 to include a monopole, dipole, or quadrapole transmitter in order to be able to process the received monopole, dipole, or quadrapole waves to be able to attenuate unwanted modes of received energy.

Claims 7-9, 23 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Leggett ('294 or '360) as applied to claims 1-4, 6, 18-22, and 25-27 above and further in view of Robbins or Coates.

With regard to claims 7- 9, 23 and 28, Leggett discloses a plurality of receivers for receiving the second signal. Leggett does not disclose that the receivers comprise a pressure sensor and a motion sensor. Leggett does not disclose that the sensors are a geophone, hydrophone, and accelerometer adjustably located to contact the formation for receiving the second signal. Robbins discloses that geophones and hydrophones are often used in downhole seismic tools in performing look-ahead measurements and

formation measurements (Column 2, Lines19-67; Column 3, Lines 26-29). It is known that accelerometers and geophones both provide directional information about the seismic waves received, and are interchangeable in many cases. It would have been obvious to modify Leggett to include geophones/accelerometers and hydrophones as taught by Robbins in order to be able to detect pressure waves and to detect seismic waves coming from a certain direction.

Coates discloses adjustably locating geophones 23 or accelerometers on a downhole tool so that they can contact the earth formation in order to obtain better seismic coupling and therefore obtain better signals (Column 4, Lines 47-55) (Fig. 2). It would have been obvious to modify the tool of Leggett to include adjustably locating the seismic receivers to that they could contact the formation and therefore achieve better acoustical and mechanical coupling for the seismic signals.

Claims 11-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Leggett '264 in view of Leggett '826 and Beresford.

With regard to claim 11, Leggett '294 discloses a method of obtaining information about a parameter of interest of an earth formation. Leggett '294 discloses using a drill bit 50 on a bottom hole assembly conveyed on a drilling tubular for drilling a borehole in the earth formation (Column 4, Lines 49-65) (Fig. 1). Leggett '294 discloses suspending drilling operations and using the drilling tubular to move the drill bit away from the bottom of the borehole (Column 9, Line 63 to Column 10, Line 10). Although Leggett '294 does not specifically disclose moving the drill bit away from the bottom of the

borehole, he does disclose that drilling is stopped before the acoustic signals are generated, and in order to stop the drilling, the drill bit would lose contact with the bottom of the borehole. Leggett '294 discloses generating an acoustic signal in the borehole axis direction into the earth formation using an acoustic source array T on the BHA (Fig. 7) (Column 13, Lines 20-54; Column 14, Lines 55-63; Column 9, Line 63 to Column 10, Line 10). Since some of the waveform travels in the borehole axis direction, the Leggett '294 reference contains the limitation of generating an acoustic signal in the borehole axis direction. Leggett '294 discloses determining a parameter of interest (acoustic velocity, bed boundary information) from a received signal resulting from a reflection of the generated acoustic signal with the earth formation (Column 9, Line 63 to Column 10, Line 10). Leggett '294 does not specifically disclose that the source array is an axially directed source array. Leggett '826 teaches a borehole logging tool mounted above a drill bit that is used to make measurements of the formation surrounding a borehole (Figs. 1, 6, 8). Leggett '826 teaches using an axially directed source array (range of angles from 0 to 180 degrees with respect to axis of the borehole includes axially directed along the borehole) to transmit signals into the formation (abstract; Column 10, Line 45 to Column 11, Line 45; Column 13, Line 30 to Column 14, Line 37). It would have been obvious to modify Leggett '294 to include an axially directed source array as taught by Leggett '826 in order to be able focus the emitted energy along desired paths for evaluating the formation and for looking ahead of the drill bit. Leggett '294 does not specifically disclose removing the drill bit from the bottom of the borehole. Beresford discloses taking the drill bit off of the bottom of the borehole

before acoustic measurements are made (Column 4, Lines 25-39). It would have been obvious to modify Leggett '294 to include lifting the drill bit off of the bottom before performing the acoustical measurements as disclosed by Beresford in order to acoustically separate the sources and receivers in the BHA from the drill bit and the bottom of the borehole.

With regard to claim 12, Leggett '294 discloses generating an acoustic signal comprising sequentially activating elements of an acoustic source array (Column 9, Lines 63-67; Column 15, Lines 42-44).

With regard to claim 13, Leggett '294 discloses that generating the acoustic signal further comprises activating elements of the acoustic source array in the borehole axial direction according to a pre-selected sequential time delay (Column 9, Lines 63-67; Column 15, Lines 42-44) (Fig. 7).

With regard to claim 14, Leggett '294 discloses that the received signal has traversed part of the earth formation that is adjacent to the borehole (Fig. 5) (Column 11, Lines 33-67).

With regard to claim 15, Leggett '294 discloses that determining the parameter of interest comprises defining a reflector imaging direction that is parallel to the axis of the borehole, oblique to the axis of the borehole, or perpendicular to the axis of the borehole depending upon the orientation of the reflector (bed boundary) (Figs. 3a, 7) (Column 11, Lines 33-67).

With regard to claim 16, Leggett '294 discloses that the generated acoustic signal is differing in a spectrum of acoustic energy of a rotating drillstring (Column 15, Lines

36-40). Leggett '294 discloses that the transmitters are adapted to transmit signals at a desired frequency level or that they can sweep a range of frequencies. Leggett '294 discloses earlier a need to get rid of background noise (Column 12), and therefore the range and selected frequencies of Leggett '294 would be different in spectrum and wave mode from the acoustic energy of the rotating drill string.

Claims 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Leggett '264 as applied to claim 18 above and further in view Beresford.

With regards to claim 19, Leggett '294 discloses suspending drilling operations to take seismic measurements. Leggett '294 does not specifically disclose removing the drill bit from the bottom of the borehole. Beresford discloses taking the drill bit off of the bottom of the borehole before acoustic measurements are made (Column 4, Lines 25-39). It would have been obvious to modify Leggett '294 to include lifting the drill bit off of the bottom before performing the acoustical measurements as disclosed by Beresford in order to acoustically separate the sources and receivers in the BHA from the drill bit and the bottom of the borehole.

The "wherein" clauses of claims 19, and 27 are essentially method limitations or statements or intended or desired use. The "further comprising sequentially firing" limitation of claim 21 is essentially a method limitation in an apparatus claim. Thus, these claims as well as other statements of intended use do not serve to patentably distinguish the claimed structure over that of the reference. See In re Pearson, 181

USPQ 641; In re Yanush, 177 USPQ 705; In re Finsterwalder, 168 USPQ 530; In re Casey, 512 USPQ 235; In re Otto, 136 USPQ 458; Ex parte Masham, 2 USPQ 2nd 1647.

See MPEP § 2114 which states:

> A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from the prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. Ex parte Masham, 2 USPQ 2nd 1647
>
> Claims directed to apparatus must be distinguished from the prior art in terms of structure rather than functions. In re Danly, 120 USPQ 528, 531.
>
> Apparatus claims cover what a device is not what a device does. Hewlett-Packard Co. v. Bausch & Lomb Inc., 15 USPQ2d 1525, 1528.

As set forth in MPEP § 2115, a recitation in a claim to the material or article worked upon does not serve to limit an apparatus claim.

Conclusion

The cited prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Scott A. Hughes whose telephone number is 571-272-6983. The examiner can normally be reached on M-F 9:00am to 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jack Keith can be reached on (571) 272-6878. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

SAH

JACK KEITH
SUPERVISORY PATENT EXAMINER